

TOPICAL REPORT

ROBOTICS & AUTOMATION

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AUTOMATION



Automatically Solve Rubik's Cube with Lightning Speed with Automation Technology from SIGMATEK

"The students from the electrical engineering department used their collective knowledge in information-, drives- and automation technology for their final project. Using image recognition and two cameras, the Rubik's Cube Solver first calculates the current arrangement of the colorful squares. Using this image, an algorithm determines the rotation sequence for solving the cube. This sequence is then sent to the control and drives in real time. The colorful squares are automatically put in position within times, which for human beings, is completely impossible."

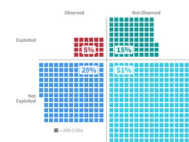
Source: Automation World

Twelve million jobs to be lost to automation in Europe by 2040

"According to Forrester, the impact on the jobs market will be lessened because Europe's biggest economies will have millions fewer people of working age. Meanwhile, it said the automation industry itself and the green energy revolution would create nine million jobs in Europe's five biggest economies.

In its Job Forecast 2020-2040, which analysed France, Germany, Italy, Spain and the UK, Forrester found that the retail, food services, and leisure

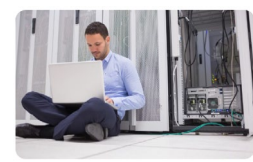
AUTOMATION



Automation of Telecom Network Vulnerability Management

"Many network assets use some free and open-source software (FOSS) or commercial off-the-shelf software (COTS) to provide industry standard services or functionality. This makes vulnerability management a crucial part of network security, same applies also to telecommunication networks. Modern, highly complex, telecommunications networks are constantly evolving and use of old methods in managing vulnerabilities, risks, in the networks will not work much longer. At the same time the number of possible vulnerabilities is increasing year by year. This thesis helps commissioner company to map the information in the pre-existing systems and services in a way that brings most value to the operators. Limiting the visibility to the risks, vulnerabilities, that really matter. This will allow efficient use of resources. The thesis is limited to the Security Manager and Vulnerability Management Service database integration, this was also the first to be implemented in the study. Integration of external vulnerability feeds and scanner reports were excluded. Excluded were also the connectivity from operator networks towards the vulnerability management database

AUTOMATION



Gartner's IT Automation Trends for 2022

"The COVID-19 pandemic has permanently disrupted the way we work, shop and access services. In response, enterprise organizations will continue to shift towards digital-first business models and cloud-native operations in 2022, with big implications for IT automation.

Each year, Gartner, Inc. releases a series of papers explaining the trends that will impact business, IT and technology in the coming years. This year's predictions range from the global (like cyberwarfare) to the more routine (DBMS retirements).

In general, most of Gartner's 2022 predictions involve IT's role becoming more prominent within the organization as digital business initiatives accelerate. So to help IT professionals plan for the coming year, we've gone through the latest Gartner research publications and pulled out the predictions most relevant to the IT automation market."

Source: IT Automation

Global Building Automation Systems Market (2021-2026) by Offering, Communication Technology & Application, and Geography, Competitive Analysis and the Impact of Covid-19 with Ansoff Analysis

and hospitality sectors would see the most automation."

Source: Computer Weekly

How to double up grocery logistics productivity with autonomous mobile robots

"Faced with the likelihood of long term staff shortages and resulting rises in pay rates, warehouse and distribution centre operators in grocery and many other sectors are turning sometimes belatedly to automation. This is certainly an option but not all solutions deliver really significant productivity improvements."

Source: Robotics and Automation

Navigating the Key Automation Delivery Phases

"Automation, artificial intelligence (AI) and straight-through-processing are having a profound effect on the global Financial Services (FS) arena. Very few industries in history have seen such a meteoric rise in popularity, with 76% of senior decision makers (1) in FS stating they believe that automation and AI will be fundamental to the success of their business. This explains the desire to adopt new technologies to allow companies to do more-with-less by increasing operational efficiency. The speed of technology adoption can leave FS firms open to falling down common automation rabbit holes during the implementation of a solution. This blog will be the first of a two part series that will aim to inform decision makers of a typical 'best practice' delivery roadmap for an automation project, using a robotics example from Be | Shaping the Future UK's (Be UK) case studies."

Source: FinExtra

AUTONOMOUS VEHICLES



Autonomous vehicle development will be stalled by technological and regulatory barriers

"Autonomous vehicles are currently more hype than substance, given the significant technological, financial, and regulatory barriers to their widespread use, according to GlobalData.

In its latest report, Tech, Media, & Telecom Predictions 2022, the data and analytics company predicts that focus will shift onto "lower-level" autonomous vehicles that require

and the UX/UI layer. Most of these will require further studies."

Source: Metropolia University of Applied Sciences

XERUS: An open-source tool for quick XRD phase identification and refinement automation

"Analysis of XRD diffraction patterns is one of the keystones of materials science and materials research. With the advancement of data-driven methods for materials design, candidate materials can be quickly screened for the study of a desired physical property. Efficient methods to automatically analyze and identify phases present in a given pattern, are paramount for the success of this new paradigm. To aid this process, the open source python package Xray Estimation and Refinement Using Similarity (XERUS) for semi-automatic/automatic phase identification is presented. XERUS takes advantages of open crystal structure databases, not relying on proprietary databases, to obtain crystal structures on the fly, being then chemical space agnostic. By wrapping around GSASII, it can automatically simulate patterns and calculate similarity measures used for phase identification. Our approach is simple and quick but also applicable to multiphase identification, by coupling the similarity calculations with quick refinements followed by an iterative peak removal process. XERUS is shown in action in four different experimental datasets and also it is benchmarked against a recently proposed deep learning method for a mixture dataset covering the Li-Mn-O-F chemical space."

Source: Cornell University

The shadows of economic growth: AI automation and globalisation

"Today's political and economic framework is marked significantly by globalisation and AI automation exponential expansion. Their advancements ensure development and prosperity – which is often not equally distributed across nations. A study showed that U.S. citizens experienced a decrease in the medium household income although their productivity increased, making the problem of distribution visible. Why is this digital era disbalancing the key drivers that used to grow in union? A possible explanation is presented in this article through variables as total factor productivity and Globalisation Index. Investment in human capital, in the form of education, is discussed."

Source: Taylor & Francis Online

"The Global Building Automation Systems Market is estimated to be USD 70 Bn in 2021 and is expected to reach USD 105.3 Bn by 2026, growing at a CAGR of 8.5%.

The global building automation system market has been driven by the growing popularity of the Internet of Things, expanding government and private sector initiatives, and rising security concerns. The use of automated security systems in buildings has increased in recent years. In addition, the development of wireless sensor networks and wireless protocol technologies is accelerating. Moreover, government programs aimed at lowering carbon emissions and increasing energy efficiency are expected to present attractive growth possibilities for the market throughout the forecast period."

Source: Research & Markets

Rise of Robotic Process Automation (RPA) and Cognitive Automation

"Digitalization is gradually replacing paper-based tasks with digital processes. Standardized and monotonous processes are prime candidates for automation through robotic process automation (RPA), which deploys software bots replicating and automating procedures across applications and environments. RPA automates repetitive, labor-intensive, and time-consuming tasks, minimizing or eliminating human involvement to drive faster and more efficient processes.

RPA has demonstrated its advantages in simple, non-decision-making processes. Industries are now considering cognitive automation, or cognitive RPA, to automate more complex functions. With technologies such as artificial intelligence and natural language processing, cognitive RPA can become a crucial component in an organization's digitalization strategy. While technological advancements in RPA systems have spurred the development of knowledge-based automation, true cognitive RPA is still nascent. Almost all major RPA deployments have no actual decision-making capabilities."

Source: Frost & Sullivan

Global Industrial Automation Outlook, 2022

"This Frost & Sullivan research service analyzes the global industrial automation market from 2020 to 2025, with 2020 as the base year. The deliverable offers an in-depth look at the dynamics influencing and challenging the growth of the industrial automation market and

greater human supervision, while mergers and acquisition activity will continue to be driven by transport technology such as robotaxis."

Source: Robotics & Automation

The self-driving car industry is abandoning the term 'self-driving' and leaving it to Tesla

"The AV industry's top lobbying group in Washington, DC is rebranding, dropping the reference to "self-driving" in exchange for a more straightforward moniker. The group, which was founded in 2016 by Waymo, Ford, Lyft, Uber, and Volvo, lobbies lawmakers to pass legislation favorable to its members. It has since grown to include the top AV operators in the country, including Cruise, Aurora, Argo AI, Motional, Nuro, and Zoox. It's the latest move by the AV industry to distance itself from the term "self-driving," which many observers interpret as an acknowledgment of Tesla's influence on the public's awareness of the technology."

Source: The Verge

Mcity Was Built to Make Autonomous Vehicles Less Scary

"In 2018, a pedestrian in Arizona was hit and killed by an Uber vehicle that was testing autonomous technology, the first such incident of its kind. Then there's Tesla CEO Elon Musk, who has been pushing boundaries with Tesla's Autopilot hands-free advanced driver assistance system. Some drivers have taken Autopilot far too literally and abdicated driving responsibilities when they shouldn't. People have died."

Source: Motor Trend

A new reality check on self-driving cars

"Some carmakers and tech companies say they're preparing to deliver self-driving cars to consumers within just a few years, a fresh promise that makes it seem like 2016 again. But beware the hype.

Why it matters: Your car might be capable of driving itself in the not-too-distant future, but only under certain conditions, like favorable weather or within certain geographic limits. And the timetable is squishy at best.

- Safety experts fear that the companies' pronouncements could build unrealistic expectations or — worse — prompt consumers to leave too much of the driving to their automobiles."

Source: Axios

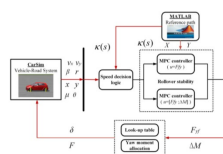
AUTONOMOUS ROBOTS

Colloquium: Advances in automation of quantum dot devices control

"Arrays of quantum dots (QDs) are a promising candidate system to realize scalable, coupled qubits systems and serve as a fundamental building block for quantum computers. In such semiconductor quantum systems, devices now have tens of individual electrostatic and dynamical voltages that must be carefully set to localize the system into the single-electron regime and to realize good qubit operational performance. The mapping of requisite dot locations and charges to gate voltages presents a challenging classical control problem. With an increasing number of QD qubits, the relevant parameter space grows sufficiently to make heuristic control unfeasible. In recent years, there has been a considerable effort to automate device control that combines script-based algorithms with machine learning (ML) techniques. In this Colloquium, we present a comprehensive overview of the recent progress in the automation of QD device control, with a particular emphasis on silicon- and GaAs-based QDs formed in two-dimensional electron gases. Combining physics-based modeling with modern numerical optimization and ML has proven quite effective in yielding efficient, scalable control. Further integration of theoretical, computational, and experimental efforts with computer science and ML holds tremendous potential in advancing semiconductor and other platforms for quantum computing."

Source: Cornell University

AUTONOMOUS VEHICLES



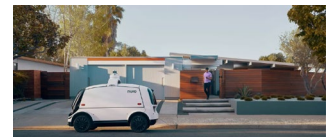
Switched model predictive controller for path tracking of autonomous vehicle considering rollover stability

"Lateral stability and rollover stability are two most crucial concerns for path tracking of an autonomous vehicle under handling limit conditions. To improve path tracking accuracy and ensure vehicle stability under handling limit conditions, this paper proposes a force-driven switched MPC path tracking control strategy that coordinates active front-wheel steering with an external yaw moment. Firstly, a linear time-varying tire model is modelled using the affine approximate linearisation method to describe rear tire dynamics. And

analyzes the process automation technology segments across process, discrete, and hybrid industries. It offers a comprehensive market overview with top digital trends to watch, growth opportunity analysis, general industrial automation outlook with market forecasts, and insights on major companies including Siemens, Emerson, Yokogawa, ABB, Schneider Electric, and Rockwell. The research also highlights future growth opportunities and the strategic imperatives market participants need to consider to capitalize on growth opportunities. Digitalization is pushing every end-user industry and market to transform their approach toward generating revenue through unique customer experiences. Investment in robotics, AI/ML, edge computing, big data, augmented reality/ virtual reality, and remote assistance technologies have accelerated during the COVID-19 pandemic, with the current momentum expected to intensify. In the long term, AI with everything, quantum computing in manufacturing, and blockchain in the supply chain will be growing technology investment areas."

Source: Frost & Sullivan

AUTONOMOUS VEHICLES



Which trends are driving the autonomous vehicles industry?

- "The Autonomous Vehicle (AV) industry has seen unprecedented levels of technological advancement.
- Regulators around the world have been tasked with creating policy and legislative frameworks for this fast-moving industry.
- We outline the latest trends to consider when developing mobility policies as the industry works towards post-pandemic recovery.

The transformational changes of mobility that have inspired academic scholars and fiction writers alike are steadily progressing to become part of our reality. The Autonomous Vehicle (AV) industry's rapid development has encouraged regulators around the world to introduce policy frameworks and legislation to enable the safe experimentation and development of the technology. As they navigate this unprecedented pace of technological advancement, we reviewed and mapped the latest



How robots learn to hike

"ETH Zurich researchers led by Marco Hutter have developed a new control approach that enables a legged robot, called ANYmal, to move quickly and robustly over difficult terrain. Thanks to machine learning, the robot can combine its visual perception of the environment with its sense of touch for the first time."

Source: ETH Zurich

Robotics Startups Seek to Build a Better Self-Driving Lawn Mower

"Hundreds of well-funded robotics startups are working on self-driving cars, self-piloting drones and shelf-diving warehouse robots. One lesser-known area that's beginning to draw the attention of investors: autonomous lawn mowers.

Electric Sheep Robotics Inc., which makes an add-on device for commercial mowers, plans to announce a \$21.5 million funding round Tuesday led by Tiger Global Management. It's one of several companies with their eyes on green pastures."

Source: Bloomberg

INDUSTRIAL ROBOTS



Industrial robotics market set to grow more than 10 percent a year

"MRF's report, Industrial Robotics Market information by Type, by End-Users, by Application and Region – forecast to 2027, says the sector will grow at a compound annual growth rate of 10.32 percent by 2026.

Industrial robotics are robotic systems designed to work mainly on assembly lines. The report covers trends in manufacturing and opportunities for the industry for the forecast period (2020-2027).

Additionally, the effects of the Covid-19 pandemic on the market value are discussed in high detail."

Source: Robotics and Automation

Giving bug-like bots a boost

"MIT researchers have demonstrated diminutive drones that can zip around with bug-like agility and resilience, which could eventually perform these tasks. The soft actuators that propel these microrobots are very durable, but they require much higher voltages

vehicle dynamics is modelled to predict vehicle states in the prediction horizon. Then, a force-driven switched MPC control strategy is proposed based on the system prediction model. The vehicle lateral stability and rollover stability are restricted using maximum tire lateral force and the zero-point moment method, respectively."

Source: Taylor & Francis Online

Adversarial Attacks on Multi-task Visual Perception for Autonomous Driving

"In recent years, deep neural networks (DNNs) have accomplished impressive success in various applications, including autonomous driving perception tasks. However, current deep neural networks are easily deceived by adversarial attacks. This vulnerability raises significant concerns, particularly in safety-critical applications. As a result, research into attacking and defending DNNs has gained much coverage. In this work, detailed adversarial attacks are applied on a diverse multi-task visual perception deep network across distance estimation, semantic segmentation, motion detection, and object detection. The experiments consider both white and black box attacks for targeted and un-targeted cases, while attacking a task and inspecting the effect on all others, in addition to inspecting the effect of applying a simple defense method. We conclude this paper by comparing and discussing the experimental results, proposing insights and future work."

Source: Ingenta Connect

Towards Safe, Explainable, and Regulated Autonomous Driving

"There has been growing interest in the development and deployment of autonomous vehicles on roads over the last few years, encouraged by the empirical successes of powerful artificial intelligence techniques (AI), especially in the applications of deep and reinforcement learning. However, recent traffic accidents with autonomous cars prevent this technology from being publicly acceptable at a broader level. As AI is the main driving force behind the intelligent navigation systems of self-driving vehicles, both the stakeholders and transportation jurisdictions require their AI-driven software architecture to be safe, explainable, and regulatory compliant. We present a framework that integrates autonomous control, explainable AI architecture, and regulatory compliance to address this issue. Moreover, we provide several conceptual models from this

developments on the AV industry post-pandemic."

Source: World Economic Forum

Autonomous Vehicles: Global Market Opportunity and Forecast Report 2021-2026 -

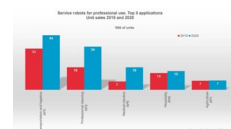
"The "Autonomous Vehicle Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2021-2026" report has been added to ResearchAndMarkets.com's offering. The global autonomous vehicle market experienced robust growth during 2015-2020. Looking forward, the market is anticipated to grow at a CAGR of around 28% during 2021-2026.

Significant growth in the automotive industry, along with rapid digitization, represents one of the key factors creating a positive outlook for the market. Furthermore, the increasing requirement for safe and efficient mode of transportation is also driving the market growth. This has resulted to a growing preference among consumers for AVs with internet connectivity, safety alerts, automatic crash notifications and enhanced engine controls.

Additionally, various technological advancements, such as the integration of artificial intelligence (AI), robotics, machine learning (ML) and the Internet of Things (IoT), are acting as other growth-inducing factors. In line with this, AV manufacturers are also using efficient light detection and ranging (LiDAR) and radio detection and ranging (RADAR) sensing technology for extensive monitoring and generation of 3D maps of the surroundings."

Source: Yahoo! Finance

ROBOTICS INDUSTRY



World Robotics 2021 – Service robots report released

"The market for professional service robots reached a turnover of 6.7 billion U.S. dollars worldwide (sample method) – up 12% in 2020. At the same time, turnover of new consumer service robots grew 16% to 4.4 billion U.S. dollars. This is according to World Robotics 2021 – Service Robots report, presented by the International Federation of Robotics (IFR). "Service robots continued on a successful path proving the tremendous market potential worldwide," says IFR President Milton Guerry. "Sales of professional service robots rose an impressive 41% to 131,800 units in 2020."

Source: RoboHub

than similarly-sized rigid actuators. The featherweight robots can't carry the necessary power electronics that would allow them fly on their own.

Now, these researchers have pioneered a fabrication technique that enables them to build soft actuators that operate with 75 percent lower voltage than current versions while carrying 80 percent more payload. These soft actuators are like artificial muscles that rapidly flap the robot's wings."

Source: MIT

SOCIAL ROBOTS

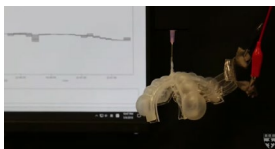


Robo-dogs and therapy bots: Artificial intelligence goes cuddly

"The World Robotics report shows that Europe is the region with the highest robot density globally, with an average value of 114 units per 10,000 employees in the manufacturing industry. For more facts about robots watch IFR's video news about Europe in one minute."

Source: CBS News

SOFT ROBOTICS



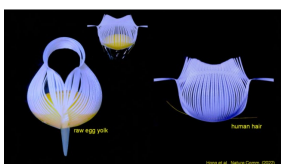
A soft, stretchable thermometer

"The next generation of soft robotics, smart clothing and biocompatible medical devices are going to need integrated soft sensors that can stretch and twist with the device or wearer. The challenge: most of the components used in traditional sensing are rigid.

Now, researchers at the Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS) have developed a soft, stretchable, self-powered thermometer that can be integrated into stretchable electronics and soft robots."

Source: Harvard School of Engineering

ACTUATORS



Kirigami Robotic Grippers Are Delicate Enough to Lift Egg Yolks

perspective to help guide future research directions."

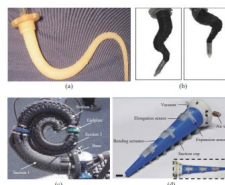
Source: Cornell University

Ride comfort assessment for automated vehicles utilizing a road surface model and Monte Carlo simulations

"The growing number of automated vehicles (AVs) necessitates good ride comfort for passengers. This research investigates currently available ride comfort methods and evaluates their performance with a validated simulation framework. The methodology developed encompasses a high-precision road surface model and uses Monte Carlo simulations to compile accurate and representative virtual chassis acceleration data. By utilizing a threshold method and standard ISO 2631 ride comfort guidelines, results are compared to classifications based on empirical International Roughness Index data. A case study conducted in Austria specifies that ISO 2631 comfort estimates are most similar to International Roughness Index classifications and that the thresholding procedure detects preventable situations and over- or underestimated ride comfort. Thus, this methodology can help to better understand requirements for AVs' comfort, as well as justifying the importance of developing a sophisticated performance metric."

Source: Wiley Online Library

SOFT ROBOTICS



Soft robotics application in manufacturing

"Robots are superior to human workers in the manufacturing industry, but cannot fully supplant humans for several reasons. It is no coincidence that industrial robots are mostly robotic arms on assembly lines. This article analyzes why robots are playing a more and more important role in manufacturing, and whether soft robotics are able to make amendments to the flaws of rigid robotics, to achieve a higher level of automation. The robots are more precise, more productive, and able to reduce the risk of human injury. But at the same time, they may be too large or too small for the product, or unable to carry out duties due to design constraints. Soft robots possess a new level of adaptability and flexibility, thanks to biomimicry, but current development of soft robotics is slow

World Robotics 2021 reports

"The World Robotics 2021 Industrial Robots report shows a record of 3 million industrial robots operating in factories around the world – an increase of 10%. Sales of new robots grew slightly at 0.5% despite the global pandemic, with 384,000 units shipped globally in 2020. This trend was dominated by the positive market developments in China, compensating the contractions of other markets. This is the third most successful year in history for the robotics industry, following 2018 and 2017. "The economies in North America, Asia and Europe did not experience their Covid-19 low point at the same time," says Milton Guerry, President of the International Federation of Robotics. "Order intake and production in the Chinese manufacturing industry began surging in the second quarter of 2020. The North American economy started to recover in the second half of 2020, and Europe followed suit a little later."

"Global robot installations are expected to rebound strongly and grow by 13% to 435,000 units in 2021, thus exceeding the record level achieved in 2018," reports Milton Guerry. "Installations in North America are expected to increase by 17% to almost 43,000 units. Installations in Europe are expected to grow by 8% to almost 73,000 units. Robot installations in Asia are expected to exceed the 300,000-unit mark and add 15% to the previous year's result. Almost all Southeast Asian markets are expected to grow by double-digit rates in 2021."

Source: International Federation of Robotics

GROWTH OPPORTUNITIES IN 3D PRINTING, ROBOTIC GRIPPERS, AUTONOMOUS MOBILE ROBOTS, AND INDUSTRIAL AUTOMATION

"The Microelectronics Technology Opportunity Engine for January 2022 covers innovations pertaining to 3D printing, robotic grippers, autonomous mobile robots, and industrial automation. Some of the innovations profiled include micro metal 3D printing technology, contactless robotics grippers, AI-based manufacturing, and autonomous mobile robots powered by Internet of Things. The Microelectronics Technology Opportunity Engine captures global electronics-related innovations and developments on a weekly basis. Developments are centered on electronics attributed by low power and cost, smaller size, better viewing, display and interface facilities, wireless connectivity, higher memory

"Engineering researchers from North Carolina State University have demonstrated a new type of flexible, robotic grippers that are able to lift delicate egg yolks without breaking them, and that are precise enough to lift a human hair. The work has applications for both soft robotics and biomedical technologies.

The work draws on the art of kirigami, which involves both cutting and folding two-dimensional (2D) sheets of material to form three-dimensional (3D) shapes."

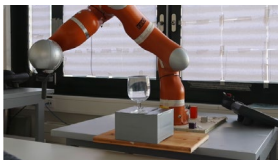
Source: NC State University

Stanford engineers develop a robotic hand with a gecko-inspired grip

"The result of this goal is "farmHand," a robotic hand developed by engineers Ruotolo and Dane Brouwer, a graduate student in the Biomimetics and Dextrous Manipulation Lab, at Stanford (aka "the Farm") and detailed in a paper published Dec. 15 in Science Robotics. In their testing, the researchers demonstrated that farmHand is capable of handling a wide variety of items, including raw eggs, bunches of grapes, plates, jugs of liquids, basketballs and even an angle grinder."

Source: Stanford University

ARTIFICIAL INTELLIGENCE



Mind-controlled robots now one step closer

"The World Robotics report shows that Europe is the region with the highest robot density globally, with an average value of 114 units per 10,000 employees in the manufacturing industry. For more facts about robots watch IFR's video news about Europe in one minute."

Source: EPFL

SOFTWARE



Smart Pendant Software Version 2.1 Expands Ease of Use and Controller Performance

"Featuring multiple improvements and optimization, Yaskawa's Smart Pendant software version 2.1 extends capability for the highly intuitive and easy-to-use Smart Pendant. Building on prior software updates, the highly

because of the difficulty in kinematic control."

Source: SPIE

Design and Simulation of Two-Fingered Soft Robotics Gripper using VoxCAD

"Growth of the field of robotics and automation is one of the rudimentary causes for the rapid industrialization and the reduction of cost and time of production of the complex products. The reason behind the growth is the task handling skills and the repeatability of the same task with higher level of accuracy and precision by the robots has overpowered the human labors in various scenarios. For the task handling, the soft robotics grippers made up of soft and smart materials are in high demand to handle more delicate objects without damaging them. The reason behind the soft materials-based gripper is that they are less power consuming, handles delicate objects, and has high dexterity and longevity. With this motivation the experiment was designed to lift the soft objects even like strawberries using the developed Two Fingered soft robotics gripper which is simulated in the VOXCAD and tested the ability to lift the object in a simulated environment and the viability to work in real world."

Source: IEEE Xplore

AUTONOMOUS ROBOTS



Robot intelligence and applications are as varied as animal intelligence, so why not treat them the same way?

"Both science fiction and the legal profession have struggled with how to think about autonomous robots, especially in terms of a framework that specifies the rights, duties, and liabilities of an agent that can act independently. Are robots like people, responsible for their actions, or are they like tools, with programmers and operators ultimately responsible? *Machinehood* ([1](#)), a science fiction novel by S.B. Divya, and *The New Breed* ([2](#)), a nonfiction examination of legal and ethical issues in robotics by K. Darling, independently promote a third metaphor: Robots are like animals. The idea is that robot intelligence and applications are as varied and as alien to our ways of cognition as animal intelligence; therefore, it is useful to treat them in the same way.

capacity, flexibility and wearables. Research focus themes include small footprint lightweight devices (CNTs, graphene), smart monitoring and control (touch and haptics), energy efficiency (LEDs, OLEDs, power and thermal management, energy harvesting), and high speed and improved conductivity devices (SiC, GaN, GaAs)."

Source: Frost & Sullivan

efficient Smart Pendant v2.1 is well-suited for quick robotic implementation of basic assembly, injection molding, inspection, machine tending, material handling, and pick and place tasks. Enabling previously unsupported functions, software v2.1 provides a built-in Classic Interface view. Ideal for more experienced robot operators, this option enables the end user to reset minor and major alarms or to edit Concurrent I/O with reduced programming downtime."

Source: Robotics Tomorrow

ROBOT-HUMAN INTERACTIONS



Creating the human-robotic dream team

"Using autonomous vehicle guidelines, a team of UBC Okanagan researchers has developed a system to improve interactions between people and robots.

The way people interact safely with robots is at the forefront of today's research related to automation and manufacturing, explains Debasmita Mukherjee, a doctoral student and lead author of a recently published study. She is one of several researchers at UBC's Advanced Control and Intelligent Systems Laboratory who are working to develop systems that allow humans and robots to interact safely and efficiently."

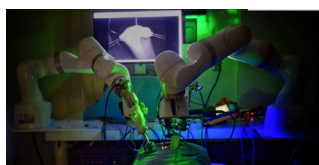
Source: University of British Columbia

Opinion: What does the future of robot-human interaction look like?

"The key idea here is that robots aren't meant to replace the human workforce but instead act as co-workers – so called cobots – supporting humans by taking on more time-consuming and higher-risk tasks, which can be hazardous for employees."

Source: Robotics & Automation News

HEALTHCARE



Robot Performs First Laparoscopic Surgery Without Human Help

This metaphor sidesteps debates over definitions and levels of autonomy and offers a path to incorporate all types of robotics into existing legal and ethical frameworks derived from bioethics."

Source: Science Robotics

Theoretical and Experimental Investigations into a Crawling Robot Propelled by Piezoelectric Material

"Conventional motors with complicated electromagnetic structures are difficult to miniaturise for millimetre- and centimetre-sized robots. Instead, small-scale robots are actuated using a variety of functional materials. We proposed a novel robot propelled by a piezoelectric ceramic in this work. The robot advances due to the asymmetric friction created by the spikes on the surface. The structural modelling was completed, static and dynamic models were established to predict the moving characteristics, the prototype was built using three dimensional (3D) printing technology, and the models were evaluated via experiments. Compared with conventional inchworm-type robots, the proposed robot is superior in simple structure because the clamping components are replaced by spikes with asymmetric friction. Compared with SMA (shape memory alloy) actuating inchworm-type robots, it has a faster velocity with higher resolution. Meanwhile, the components are printed through an additive manufacturing process that is convenient and avoids assembly errors. This design could make contributions to many areas, such as pipe inspection, earthquake rescue, and medicine delivery."

Source: MDPI

A Study on Localization of Floating Aquaculture Sludge Collecting Robot

"The recirculating aquacultural system discharges the wastewater in the form known as aquaculture sludge which composes of suspended solids, nitrogen, and phosphorus. Aquaculture sludge is recognized as the significant factor that causes the pollutant water, resulting in a decrease in productivity. Thus, aquaculture sludge needs to be removed from the aquaculture pond frequently due to its harmful effect. This paper studies the localization method of a floating aquaculture sludge collecting robot. The localization method is conducted by fusing the signals of a global positioning system (GPS), a Real-Time Kinematic (RTK), and a custom universal joint attached potentiometer to localize the real-

"A robot has performed laparoscopic surgery on the soft tissue of a pig without the guiding hand of a human—a significant step toward fully automated surgery on humans. Designed by a team of Johns Hopkins University researchers, the Smart Tissue Autonomous Robot, or STAR, is described today in Science Robotics. "Our findings show that we can automate one of the most intricate and delicate tasks in surgery: the reconnection of two ends of an intestine. The STAR performed the procedure in four animals and it produced significantly better results than humans performing the same procedure," said senior author Axel Krieger, an assistant professor of mechanical engineering at Johns Hopkins' Whiting School of Engineering."

Source: John Hopkins University

Opinion: Predictions about the surgical robots market

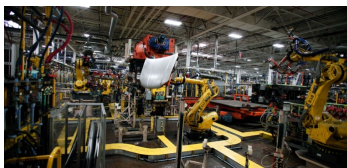
"Surgery has evolved from open surgery to robotic surgery. Surgical robots can perform complex procedures with geometrical precision, even in anatomical areas that are difficult to reach by human surgeons.

This is resulting in increased demand and adoption of minimally invasive surgeries and is one of the key drivers for the growth of the surgical robotics market.

So here are some predictions that foresee changes in the coming year within the surgical robotics market, telehealth and telesurgery, and augmented intelligence."

Source: Robotics & Automation

SUPPLY CHAIN



Robotics, automation go from fringe to mainstream

"Robots are often in the news for sensational reasons: The Boston Dynamics robot dog impersonates Mick Jagger; a Spider-Man "stuntronic" flies over Disneyland visitors.

But in supply chain, robotics and automation have gone from something radical, even fringe, to mainstream.

"It's considered low risk. And, pretty soon, it's going to be table stakes for operations within supply chain, where 10 years ago it was considered either cutting, or bleeding edge, or risky," said Jeff Christensen, vice president of product at Seegrid."

Source: Supply Chain Dive

time position of the floating aquaculture sludge collecting robot. The experimental result of the proposed positioning method is carried out to validate the effectiveness."

Source: Springer Link

SOCIAL ROBOTS

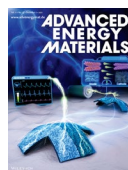


A Robot, Meteorologist, and Amateur Forecaster Walk into A Bar: Examining Qualitative Responses to A Weather Forecast Delivered via Social Robot

"The current study examines qualitative responses from participants about their opinions on a weather forecast delivered by a professional meteorologist, an amateur meteorologist, and a social robot standing in for a meteorologist. Through thematic analyses, this study identified that people evaluated each weather forecast agent's performance based on two major criteria: message factors and messenger factors. Two themes emerged from the category of message factors: an enjoyable/entertaining experience and commentary on the forecast content and information. Five themes were identified under the category of messenger factors: an expectancy violation or uncertainty which made participants uncomfortable, a distraction to the point it impeded focus on the forecast, vocalization concerns, unprofessional delivery, and commentary on the stimuli being "cute"/perceiving it as a joke. Findings further illustrate the expectancy violation people experienced while encountering a robot and/or amateur forecaster."

Source: Taylor & Francis Online

ACTUATORS



Stretchable Zn-Ion Hybrid Battery with Reconfigurable V2CTx and Ti3C2Tx MXene Electrodes as a Magnetically Actuated Soft Robot (Adv. Energy Mater. 45/2021)

"In article number 2101862, Yusheng Zhao, Po-Yen Chen and co-workers report stretchable Zn-Ion hybrid

batteries composed of V2CTx MXene cathodes and zinc-decorated Ti3C2Tx MXene anodes with crumple-like microtextures, enabling unique folding/unfolding behaviors to attenuate in-plane stress. The stretchable Zn-ion battery is rechargeable and features large deformability, ultrathin device configuration, low areal weight, and ultralow self-discharge rates. The stretchable battery can be further transformed into a magnetically actuated soft robot with remote control, capable of crawling back and forth for charging/discharging tasks."

Source: Wiley Online Library

Modeling and Controlling the Actuator Joint Angle Position on the Robot Arm Base Using Discrete PID Algorithm

"DC motor is a motor that is easy to apply. Its application in robotic DC motor control often occurs errors due to the existing load, so that the DC motor becomes inaccurate. The control used is PID (proportional integral differential). This PID control system works by processing calculations based on the control variables K_p , K_i , and K_d to achieve the conditions according to the expected setpoint. To make a DC motor position control device can be controlled with a PID controller. In practice, the variable to be controlled in this research is position control in the form of degrees. With the Arduino Mega controller, the motor driver as a DC motor rotation controller, the DC motor is given feedback in the form of an encoder sensor, the software used is the Arduino IDE. The results showed that PID control can correct errors and transient responses with a time constant value of 1.50 seconds, a rise time of 1.60 seconds, a settling time of 2.30 seconds and a delay time of 1.20 seconds and a peak time of 1.6 seconds and an error value of 0.33% through tuning parameter $K_p = 16$ $K_i = 0.001$ $K_d = 16$."

Source: Ultima Computing

HUMAN-ROBOT INTERACTION



An Innovative Mechanical Solution to Better Understand Human-Robot Interaction Forces

"This paper describes the design and development of a new mechanical layout for the integration of additional

sensors on robots that directly interact with humans. This specific work starts from the need to control human-robot interaction forces in order to ensure safety for users. The activity consisted on the conceptualization and design of a new mechanism, with the aim of including two sensors: a force/torque sensor to measure interaction forces and a linear encoder that let to know the real configuration of the device. The solution has been tested on a specific device named WristBot, whose limits are the inability to directly measure forces applied to it by humans and the impossibility to know precisely the end-effector position, with the consequences of relevant errors in calculating the interaction forces."

Source: Springer Link

ROBOT AND MOVEMENTS



Development of Data Gloves for Humanoid Robot Hand Simulation and Hand Posture Recognition

"Human hand movement data set is valuable in many practical applications. Scientists and engineers study human biometric movement data to understand how to interact with the surroundings to mimic the process in humanoid, to create prosthetic for the disables, or to visualize human's motions in entertaining products. Therefore, using a sensor integrated gloves is an effective method to collect human hand movement data. In this paper, the construction of data gloves is presented step by step from the hardware design, embedded data collecting to data processing to rebuild the human hand posture in a visualization tool. The gloves are applied a system of inertial measurement units (IMUs) to track the human hand movement to increase the accuracy, reliability, and the flexibility in comparison to those using other types of sensors. The glove built-in embedded system can collect and process the wrist and phalanges orientation data from the IMUs to model a simplified human hand of 22 degrees of freedom. Using the acquired human hand data, the Multilayer Perceptron algorithm (MLP) data is applied for hand posture recognition with fast and high accurate results."

Source: Springer Link

Reproducing arm movements based on Pose Estimation with

robot programming by demonstration

"Teaching robot movements has always been considered a complex topic in which there is much interest, since the slightest change in the robot's programming can generate a high downtime that can last for months. In this work, we carried out a study of human movements to implement a new method of Robot Programming by Demonstration (RPbD) using neural networks. Current methods require specialists with high mathematical and logical knowledge to teach robot movements. Using a famous pose estimation algorithm called OpenPose and a 3D lifting method we obtain the estimated pose of the person arm in a simulated 3D space. Then, we use various classification tools to translate it to the robot. The results show that it is feasible to make robot programming more accessible using pose estimation."

Source: IEEE Xplore

Optimal Control of a 3-link Robot Manipulator Moving to a Prescribed Point

"This paper presents a method to determine a point-to-point trajectory of a 3-dof manipulator while minimizing the control variables. This problem is often studied in many industries. The proposed solution includes the following steps. First, the method of transformation matrix is used to derive the ordinary differential equations (ODE) of motion of the mechanical system. Then, the Hamiltonian function is formed with the functional to minimize the control inputs and fix the end effector's target point. The necessary condition for optimality is derived by the Pontryagin's maximum principle. The obtained equations of two-point boundary value problem are solved to determine the optimal control using Maple software."

Source: Springer Link

Model-Based Iterative Learning Control Algorithm and Its Simulation Research in Robot Point Position Control

"Iterative learning control (ILC) uses iterative correction to achieve the predetermined goal improvement, especially suitable for the point position control system of the robot, to achieve high-precision tracking of the desired trajectory within a limited time interval. The iterative algorithm step relies on the precise mathematical model of the system, but uses the previous control information and error information to form the input signal. Therefore, the iterative algorithm provides an effective method for

robots with highly nonlinear, strongly coupled, and time-varying systems. Therefore, the purpose of this article is to study the model-based IIC algorithm and its simulation application in robot point control. This article first summarizes the basic theory of IIC algorithm, and then studies the basic process of its algorithm. On this basis, the robot point position control algorithm is simulated and analyzed. This research uses comparative method, observation method and other research methods to study the subject of this article. Experimental research shows that compared with the traditional robot point control system; the operating efficiency of the robot point control simulation system based on the model-based iterative control algorithm exceeds 15%."

Source: Springer Link

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